



IJCRR
Section: Healthcare
Sci. Journal Impact
Factor: 6.1 (2018)
ICV: 90.90 (2018)



Copyright@IJCRR

Haematological Profile of Patients with Various Types of Malaria

Rajneesh Berdia¹, Naresh Gurbani², Prince Lokwani³

¹Associate Professor, Department of Pathology, People's College of Medical Sciences and Research Centre, Bhanpur, Bhopal, MP, India;

²Professor, Department of Pathology, People's College of Medical Sciences and Research Centre, Bhanpur, Bhopal, MP, India; ³Assistant Professor, Department of Pathology, People's College of Medical Sciences and Research Centre, Bhanpur, Bhopal, MP, India.

ABSTRACT

Background: Malaria is a disease that is known to be a life-threatening infectious disease and is associated with calamitous complications in many cases and can have drastic and far-reaching consequences in a population. It is one of the parasitic infectious diseases that may affect haematological parameters. Most common haematological complications associated with malaria are Anemia, leukocytosis, thrombocytopenia and leucopenia. The magnitudes of these changes vary with endemic malaria, background hemoglobinopathy, nutritional status, demographic factors and immunity from malaria.

Aim: The main objective of this study is to evaluate the haematological profile of patients infected with malaria.

Material and methods: Total 120 malarial positive patients with the cases of haematological disorders were included in this study. From the patient's Blood samples referred for peripheral blood, the smear was collected in ethylenediaminetetraacetic acid (EDTA) and were also analyzed for malarial parasites with conventional microscopy. Giemsa stain was used for Peripheral smear and also PCV, Hb and WBCs Total counts, RBC morphology, and WBCs differential count and platelet counts are also done.

Result: In this study, the main clinical feature was chill fever. Anaemia was seen in almost all cases of malaria. Leucopenia was seen in 29.17% of cases. The incidence of leucopenia was 29.4% in *P. vivax* and in *P. falciparum* was 27.6% and 33.3% in both *P. vivax* and *falciparum*. Monocytosis was seen in 48.24% cases of *P. vivax* and 17.24% cases of *P. falciparum* and 33.33% of incidence in both *P. vivax* and *falciparum*. The significant co-relation between thrombocytopenia and Malaria was found in this study.

Conclusion: This study showed that almost all blood components and is a true haematological infectious disease and in *P. falciparum* substantially higher compared with *P. vivax*.

Key Words: Malaria, *P. falciparum*, *P. vivax*, Thrombocytopenia

INTRODUCTION

Malaria is a disease which is considered as life-threatening infectious disease and in several cases, it is associated with calamitous complications and can inflict drastic and far-reaching consequences within a community.¹ About 250 million cases in a year were estimated and between one to two million deaths.² This disease is caused by parasitic infection of genus Plasmodium, which gets injected into the human bloodstream through the bite of a female Anopheles mosquito.³ There are four species of Plasmodium have been known to cause infections in humans such as *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*. However, *P. knowlesi* as another

species was known to causes infection in macaque monkeys and reported to cause malaria in humans.^{4,5} World Health Organization (WHO) showed about 40% of the world's people are at risk of malaria. About 300 - 500 million cases of incidence with malaria per year and two million deaths per annum globally have been reported by studies.⁶ The magnitude of these changes varies with endemic malaria, background hemoglobinopathy, nutritional status, demographic factors and immunity from malaria.^{7,8,9} Parasitic infection such as malaria changes in haematological parameters likely to be influenced including endemic diseases that can affect the health of people with various clinical manifestations. Especially in the tropical areas of the world Malaria is a major

Corresponding Author:

Dr. Naresh Gurbani, Professor, Department of Pathology, People's College of Medical Sciences and Research Centre, Bhanpur, Bhopal, MP, India.

ISSN: 2231-2196 (Print)

ISSN: 0975-5241 (Online)

Received: 15.05.2020

Revised: 05.07.2020

Accepted: 15.07.2020

Published: 08.08.2020

cause of deaths. In 2010 about 219 million cases were reported worldwide.¹⁰ Patients with malaria have to have significantly lower platelets; WBCs, eosinophils, lymphocytes; RBCs and Hb level whereas neutrophil and monocyte counts were significantly higher in comparison to non-malaria infected patients.^{11,12} Thrombocytopenia is the most common complication during malaria. People having platelet counts < 150,000/ μ L were 12-15 times more likely to have malaria than people with platelet counts > 150,000/ μ L.¹³ Over recent years Malaria infection has been increasing due to a combination of factors including malarial parasites increasing resistance to chemotherapy, Anopheles mosquito vector increasing resistance to insecticides, changes in ecologic and climate and international travel increased to malaria-endemic areas.¹⁴ For the diagnosis of malaria, peripheral blood smear is considered as Gold standard to show blood smear with the parasite. However in malaria, there is a correlation between Hb, WBC counts, platelet count and morphology of RBC. Therefore haematological changes indicate that clinician must develop an efficient and early therapeutic intervention to prevent significant complications from occurring¹⁵. The main objective of this study is to evaluate the haematological profile of patients infected with malaria.

MATERIAL AND METHODS

This study was conducted in the Department of Pathology People's College of Medical Sciences and Research Centre, Bhanpur, Bhopal. Total of 120 malarial positive patients with the cases of haematological disorders was included in this study. In this study, patients were convinced for the involvement of sampling method through screening patients admitted from the clinical departments. Detail history of patients was taken as a form of recorded data from the patient's parents or caretaker. From the patient's Blood samples referred for peripheral blood, the smear was drawn through venipuncture by professional staff and 3 ml blood were collected in ethylenediaminetetraacetic acid (EDTA) and were also analyzed for malarial parasites with conventional microscopy. From the sample, the smear was reported as positive when ring forms, schizonts or the sexual forms of any of the species of malaria was seen in the peripheral blood smear. According to their characteristics, morphologic features on microscopy they are further classified. Giemsa stain was used for peripheral smear and also Haemoglobin (Hb) and Total counts of white blood cells, red blood cells morphology and differential count of WBCs and platelet counts are also carried out.

RESULT

In this study total, 120 malarial positive patients were included in which 75 were males and 45 were females with

the ratio 5:3. The mean age of patients was 27 ± 16.45 years. In this study, male predominance was found. Out of total 120 positive cases, 85 (70.83%) were positive for *P. vivax*, 29(24.17%) for *P. falciparum* and 6(5%) had mixed parasitemia, including both *P. vivax* and *P. falciparum* malarial parasites. However, the male to female ratio did not vary significantly across different malarial species. The table no 1 below showed the anaemic cases according to the gender as below 10g/dl or above 10g/dl.

Table 1: Showing gender-wise distribution of anaemic cases.

Gender	Below 10g/dl	Above 10g/dl
Male	18	57
Female	11	34

Table 2: Showing mean Hb Value with species.

Species	Numbers	Mean Hb Value
<i>P. vivax</i>	85	11.61
<i>P. falciparum</i>	29	11.36
Both <i>P. vivax</i> and <i>falciparum</i>	6	11.14

The above table showed Mean Hb was 11.61g/dl for *P. vivax* and 11.36g/dl for *P. falciparum* and 11.14g/dl for both *P. vivax* and *falciparum* cases. This was an insignificant finding in this study.

Table 3: Showing mean total count of WBCs according to species.

Species	Numbers	Mean (WBCs/cumm)
<i>P. vivax</i>	85	5289
<i>P. falciparum</i>	29	4890
Both <i>P. vivax</i> and <i>falciparum</i>	6	4798

In the above table showed Mean WBC counts was 5289cells/cumm for *P. vivax* and 4890 cells/cumm for *P. falciparum* and 4798 cells/cumm for both *P. vivax* and *falciparum*.

Table 4: Cases of Leukopenia according to species.

Species	Numbers	Percentage
<i>P. vivax</i>	25	29.4
<i>P. falciparum</i>	8	27.6
Both <i>P. vivax</i> and <i>falciparum</i>	2	33.3

The above table showed as Leucopenia was observed in malarial cases. In which *P. vivax* was 29.4% and in *P. falciparum* was 27.6% and 33.3% in both *P. vivax* and *falciparum*.

Table 5: Cases of monocytosis according to species.

Species	Within normal range	Above normal range	Total
<i>P. vivax</i>	44	41	85
<i>P. falciparum</i>	24	5	29
Both <i>P. vivax</i> and <i>falciparum</i>	4	2	6
Total	72	48	120

The above table showed monocytosis observed in malarial cases. The incidence in *P. vivax* and *P. falciparum* cases was 48.24% and 17.24% respectively and 33.33% of incidence in both *P. vivax* and *falciparum*.

Table 6: Cases showing thrombocytopenia according to species.

Species	Thrombocytopenia	Normal	Percent
<i>P. vivax</i>	62	23	72.9
<i>P. falciparum</i>	25	4	86.2
Both <i>P. vivax</i> and <i>falciparum</i>	5	1	83.3

The above table showed Thrombocytopenia was a significant finding to 76.67% cases. *P. vivax* and *P. falciparum* cases showed Thrombocytopenia as 72.9% and 86.2% respectively and 83.3% showed Thrombocytopenia for both *P. vivax* and *falciparum*.

Table 7: Showing Mean value of platelets with species

Species	Numbers	Mean (plts/cu mm)
<i>P. vivax</i>	85	77233
<i>P. falciparum</i>	29	70828
Both <i>P. vivax</i> and <i>falciparum</i>	6	70716

The above table showed mean value of the platelets counts with the species of malaria. *P. vivax* and *P. falciparum* showed as 77233 plts/cu mm and 70828 plts/cu mm respectively and 70716 plts/cu mm were shown by both *P. vivax* and *falciparum*.

DISCUSSION

Malaria poses an immense challenge for primary health provider that affects blood indices in various ways with thrombocytopenia and anaemia. Hence major investment and all aspects of malaria need to be taken seriously. Many studies have shown that thrombocytopenia as a sensitive marker for

a malaria diagnosis having a sensitivity of 60%, a specificity of 88% and a positive and negative predictive value of 86% and 100%, respectively.^{16, 17} In this study out of total 120 positive cases, 85 (70.83%) were positive for *P. vivax*, 29 (24.17%) for *P. falciparum* and 6(5%) had mixed parasitemia, including both *P. vivax* and *P. falciparum* malarial parasites which were concordance with the findings of Erhart et al.¹⁸ and Jadhav UM et al.¹⁹. Studies of Rasheed et al.²⁰ and Abro et al.²¹ showed that *falciparum* was the most common species in their studies which was similar to this study.

In this study Hemoglobin (Hb) was 11.61g/dl for *P. vivax* and 11.36g/dl for *P. falciparum* and 11.14g/dl for both *P. vivax* and *falciparum* cases, because of the awareness in patients who had a fever with chills, and came to a diagnostic laboratory for malaria that was detected early and reduced malaria complications. Similarities were also found in the study of Menendez C et al.²². and Sitalakshmi S et al.²³. In this studied Mean WBC counts were not significant this was also shown by the other studies of Erhart et al.²⁴ and Taha et al.²⁵

Leucopenia was observed 29.17% in malarial cases and that represent the hypersplenism condition which was similar to the studies of Kassa et al.²⁶ and Rasheed et al.²⁷

In this study monocytosis observed in 40% of malarial cases which was opposite to the study of Aktar et al.²⁸ as it shows 18.9% cases of cases which represent high reticuloendothelial activity.

In this studied thrombocytopenia was a significant finding to 76.67% cases of malaria. This may be due to enhanced splenic uptake, the triggers mediated by DIC and immune systems.

This finding was also comparable with other studies conducted by Okocha et al.²⁹ and Jhadav et al.³⁰ Thrombocytopenia consists of the common characteristic of acute malaria and occurs in both *P. falciparum* and *P. vivax*, irrespective of the severe infection. During a case of fever, the lack of regular volume of platelets on a peripheral blood smear is also a sign for malaria diagnosis.

CONCLUSION

In the malarial disease, almost all blood components and is a true haematological infectious disease. Therefore higher malarial parasitic index was associated with lower platelet counts. In the cases of *P. falciparum* haematological parameters are more affected compared to *P. vivax*. Hence *P. falciparum* has more morbidity than *P. vivax* and if left untreated will lead to severe complications.

Acknowledgement: Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are

also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Ethical clearance- Taken from the institutional ethics committee.

Source of funding- Self.

Conflict of Interest – nil.

REFERENCES

1. Shaikh QH, Ahmad SM, Abbasi A, et al.: Thrombocytopenia in malaria. *J Coll Physicians Surg Pak*. 2009, 19:708-10.
2. Sturchler. How much malaria is there worldwide? *Parasitol Today* 1989; 5:39.
3. Schlagenhauf-Lawlor P: Travelers Malaria. BC Decker, Inc, Ontario; 2007.
4. Collins WE: Plasmodium knowlesi: a malaria parasite of monkeys and humans . *Annu Rev Entomol*. 2012, 57:107-21. 10.1146/annurev-ento-121510-133540
5. Chin W, Contacos PG, Coatney GR, Kimball HR: A naturally acquired quotidian-type malaria in man transferable to monkeys. *Science*. 1965, 149:865.
6. Ullah I, Ali MU, Ali S, Rafiq A, Sattar Z, Hussain S. Hematological Profile of Patients Having Malaria-positive Peripheral Blood Smears: A Cross-sectional Study at a Diagnostic Research Center in Khyber Pakhtunkhwa, Pakistan. *Cureus*. 2018; 10(9).
7. Erhabor O, Mohammad H et al. "Effect of plasmodium parasitaemia on some haematological parameters in children living in Sokoto, North Western, Nigeria," *International Journal of Clinical Medicine Research*, 2014; 1(2) 57–64.
8. Casals-Pascual C, Kai O et al. "Short report: thrombocytopenia in falciparum malaria is associated with high concentrations of IL-10," *American Journal of Tropical Medicine and Hygiene*, 75(3) 434–436.
9. Cox D & McConkey S, "The role of platelets in the pathogenesis of cerebral malaria," *Cellular and Molecular Life Sciences*, 2010; 67(4): 557–568.
10. WHO: World malaria report 2012. Geneva: World Health Organization; 2012.
11. Erhart LM, Yingyuen K, Chuanak N, Buathong N, Laoboonchai A, Miller RS, Meshnick SR, Gasser RA Jr, Wongsrichanalai C: Hematologic and clinical indices of malaria in a semi-immune population of western Thailand. *Am J Trop Med Hyg* 2004; 70:8–14.
12. Adedapo AD, Falade CO, Kotila RT, Ademowo GO: Age as a risk factor for thrombocytopenia and anaemia in children treated for acute uncomplicated falciparum malaria. *J Vector Borne Dis* 2007, 44:266–271.
13. Shiraz Jamal Khan YA, Mumtaz Ali M: Thrombocytopenia as an Indicator of Malaria in Adult Population. *Malar Res Treat* 2012, 405981:1–4.
14. Worrall E, Basu S, Hanson K. Is malaria a disease of poverty? a review of the literature. *Trop Med Int Health*. 2005; 10(10):1047–1059.
15. Ahmed S, Zakaria F, Aravind P. Variation of haematological indices in various types of malaria. *Journal of Evolution of Medical and Dental Sciences*. 2014; 26;3(21):5916-25.
16. Lathia TB, Joshi R: Can hematological parameters discriminate malaria from nonmalarious acute febrile illness in the tropics? *Indian J Med Sci*. 2004, 58:239-44.
17. Patel U, Gandhi G, Friedman S, Niranjana S: Thrombocytopenia in malaria. *J Natl Med Assoc*. 2004, 96:1212-14.
18. Erhart LM, Yingyuen K, Chuanak N, Buathong N, Laoboonchai A, Miller RS et al. Hematologic and clinical indices of malaria in a semi-immune population of Western Thailand. *Am J Trop Med Hyg*. 2004; 70(1):8–14.
19. Jadhav UM, Patkar VS, Kadam NN. Thrombocytopenia in malaria—correlation with type and severity of malaria. *J Assoc Physicians, India*. 2004; 52:615–618.
20. Rasheed A, Saeed S, Khan SA. Clinical and laboratory findings in acute malaria caused by various plasmodium species. *J Pak Med Assoc*. 2009; 59(4):220–223.
21. Abro AH, Saleh AA, Abdou AS, Ustadi AM, Shuri HMH, Seliem RM. Thrombocytopenia in adults with acute malaria. *RMJ*. 2009; 34(2):170–172.
22. Menendez C, Fleming AF, Alonso PL. Malaria-related anaemia. *Parasitol Today*. 2000; 16(11):469–476.
23. Sitalakshmi S, Srikrishna A, Devi S, Damodar P, Mathew T, Varghese J. Changing trends in malaria—a decade's experience at a referral hospital. *Indian J Pathol Microbiol*. 2003; 46(3):399–401.
24. Erhart LM et al. Hematologic and clinical indices of malaria in a semi-immune population of western Thailand. *Am J Trop Med Hyg*. 2004; 70:8-14
25. Taha et al. Hematological Changes in Malaria: Relation to Plasmodium Species. *Kuwait Medical Journal* 2007, 39 (3): 262-267.
26. Kassa et al. Parasito-haematological features of acute Plasmodium falciparum and P. vivax malaria patients with and without HIV co-infection at Wonji Sugar Estate, Ethiopia. *Ethiop J Health Dev*. 2005; 19(2):132-139.
27. Rasheed et al. Clinical and laboratory findings in acute malaria caused by various plasmodium species. *JPMA*. 59:220; 2009.
28. Aktar et al. Hematological changes in malaria: A comparative study. *IOSRJPBS*. 2012;2(4):15-19.
29. Okocha et al. The prevalence of malaria parasitaemia in blood donors in a Nigerian teaching hospital. *J Vect Borne Dis*. 2005; 5: 21–24.
30. Jhadav et al. Thrombocytopenia in Malaria - Correlation with Type and Severity of Malaria. *JAPI* . 2004; 52: 615-618.